REPORT ON AN INVESTIGATION OF A PUBLIC WATER SUPPLY SYSTEM WHICH SERVES THE CITY OF BELOIT, WISCONSIN AND SOUTH BELOIT, ILLINOIS

The following report describes the public water supply system which serves Beloit, Wisconsin, and South Beloit, Illinois. The public water supply in Wisconsin is owned by the Wisconsin Power and Light Company (WP&L), and in Illinois by the South Beloit Water, Gas, and Electric Company, a subsidiary of WP&L. The survey was done on July 22 and 23, 1981, as one of a series of routine investigations of such systems in the state of Wisconsin. Messrs. Rodney Nilles, Robert Bert, and Verne Horne, the certified waterworks operator and area mechanical superintendent, mechanical engineer, and gas meter shop foreman for WP&L, respectively, Walter Purcell, Environmental Protection Engineer for the Illinois Environmental Protection Agency (IEPA), and Robert Weber of this department accompanied me on the tour of the facilities.

General Information

Beloit is located on the southern edge of Rock County, Wisconsin, and South Beloit is located on the northern edge of Winnebago County, Illinois, and is about 50 miles south of Madison, Wisconsin. The public water supply serving these cities consists of eight wells, three elevated tanks, three pressure zones, and a distribution system. Well #3 is located in South Beloit, and all the other facilities are located in Beloit. The distribution systems are interconnected in fifteen locations, and water can flow freely in either direction across the state line.

The water system began operation in 1885, and was owned and operated by the Beloit Waterworks Company until 1906. At that time the company reorganized as the Beloit Water, Gas, and Electric Company, until 1925 when it was purchased by WP&L.

The present active wells for the system are numbered as follows: #3, #4, #5, #8, #9, #10, #11, and #12. Wells #1, #2, #6, and #7 were apparently part of the original system, and have not been used for at least 20 years. There were apparently two major stations that originally served the system, the East Side Station and the Electric Plant Station.

The East Side Station was located near Pleasant and Eclipse Streets, near the present site of well #4. The station took its supply from a series of driven point wells ranging in depth from 80 to 150 feet, all drilled prior to 1926. The wells flowed to a 423,000-gallon reservoir, and a 14-inch cast iron suction line in the reservoir led to a series of pumps with a capacity of about 1,500 gallons per minute (gpm). The reservoir was 30 feet in diameter and 40 feet deep. There is a nearby tower foundation constructed of field stone which may have provided the original system's pressure storage. The old wells #1 and #2 are believed to have been located here.

At the Electric Plant Station, wells #6 and #7 were believed to have been located. This station also took its supply from a series of driven point wells, each about 100 feet deep. The wells were connected to a 10-inch suction line, but no information is available describing how this water was pumped from there to the system.

Evaluation of Existing Facilities

Well #3

This well is located in South Beloit, Illinois, near the intersection of Clark Street and Pershing Drive, by the Chicago and Northwestern Railroad tracks. The well was drilled in 1937 by C. W. Varner, of Dubuque, Iowa. The well construction consists of an 18-inch casing from the surface to a depth of 230 feet, with a 17-inch drillhole extending from there to a depth of 352 feet, and a 12.75-inch drillhole from that depth to the bottom of the well at 1,190 feet. There is no information available on the original static water level or specific capacity of the well. Also, the well casing is not surrounded by cement grout.

Since this well is located in Illinois, it will be considered an interconnection with the Beloit, Wisconsin public water supply, in accordance with Section NR 111.25(3), Wisconsin Administrative Code (WAC). In order to meet the requirements of that chapter, it must also meet the requirements of Section NR 111.31(1), WAC which requires all wells to have watertight construction to such depths as may be required to exclude contamination, and to have a protective casing in the well surrounded by a grout seal. Since the well does not have a grout seal around the existing casing, it will be required that a smaller diameter inner liner be installed in the well, with the annular space between that liner and the existing casing to be filled in with cement grout. Preferrably, a minimum of five feet of grout should be in contact with the native geologic formation; in this case, to the bottom of the St. Peter sandstone.

There are two reasons for this request. The absence of the sealing material, cement grout, could allow water of questionable quality from near the ground surface to quickly flow down around the 18-inch casing and possibly contaminate the well in that manner. Cement grout is also used to extend the life of the well casing, by providing an extra layer of protection against corrosion of the casing. Since the casing has been in the ground since the well was constructed in 1937, it may be deteriorating.

This well is presently equipped with a 1,300-gpm Layne vertical turbine pump powered by a 150-horsepower (hp) electric motor, which discharges directly to the distribution system. The termination of the air-vacuum relief valve piping should be brought up above the pumphouse floor at least two feet, and terminated with a fine mesh screen. The ground reservoir located at this pump station has been completely disconnected from the water system and the centrifugal booster pump that used to be here has been eliminated.

Well #4

This well was drilled in 1926 by C. W. Varner and is the oldest active well in the supply system. The well is located on Pleasant Street between Woodward Avenue and Tower Street in Beloit, Wisconsin. The well construction consists of an 18-inch pipe from the surface to a depth of 256 feet, with a 17-inch drillhole continuing from there to a depth of 300 feet, and a 12-inch drillhole continuing from there to the bottom of the well at 967 feet. There is no information available on the original static water level or specific capacity of the well.

This well also does not have a protective grout seal around the well casing. At the time of the reconstruction planned for this well in 1982 or 1983, the well and pumphouse should be brought up to the minimum requirements as stated in Section NR 111, WAC. This would include grouting a liner pipe in the well and providing an above-ground discharge. This well is presently equipped with a 1,000-gpm Layne vertical turbine pump that discharges directly to the distribution system and is powered by a 150-hp electric motor.

Well #5

This well is located on Liberty Street between Eleventh Street and Hackett Street. This well was drilled in 1927 by C. W. Varner, and the construction consists of a 17-inch casing to a depth of 256 feet, a 12-inch open drillhole from there to a depth of 312 feet, and an eight-inch drillhole from there to the bottom of the well at 1,225 feet. There is no information available on the original static water level or the specific capacity for this well.

As with wells #3 and #4, this well will also have to be reconstructed so that a protective grout seal is provided for the well and the below-ground discharge eliminated.

This well is presently equipped with a 1,100-gpm Fairbanks Morse vertical turbine pump which discharges directly to the system and is powered by a 150-hp electric motor.

Well #8

This well was drilled in 1945 by the Varner Well Drilling Company and is located by the Rock River near the intersection of Pleasant and Emerson Streets. The well is a 140-foot deep gravel packed well. The well construction consists of a 30-inch pipe from the surface to a depth of 60 feet, inside of which is a 24-inch casing to a depth of 92 feet 10 inches. The annular space between these two casings to 60 feet is cement grouted. A stainless steel well screen is attached to the bottom of the 24-inch casing and extends to the 140-foot depth, and is surrounded by gravel pack.

The well is presently equipped with a 4,300-gpm Fairbanks Morse vertical turbine pump powered by a 400-hp electric motor and discharges directly to the distribution system. The termination of the air-vacuum relief